

**MALCOLM
PIRNIE**

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INTER-OFFICE CORRESPONDENCE

To:.....R.P. Brownell.....

Date:.. 8/5/82.....

From:.....H. L. Shahabian.....

Subject: ... Waukegan Harbor Siltation.....

The review of available reports and data related to sedimentation/siltation of Waukegan Harbor resulted in the following:

1. The main source of siltation and sedimentation of Waukegan Harbor appears to be Lake Michigan. Based on a limited sampling period performed by Argonne National Laboratory, a two-phase flow often exists at the mouth of the Harbor: Water flows out of the harbor at the surface and correspondingly into the Harbor at the bottom of the channel. The bottom current from the Lake carries with it sediments that are deposited in the channel.
2. The channel and a portion of the Harbor located near the mouth have been regularly dredged in the past. The average quantity of dredged material was 20,000 yd³/year.
3. No dredging has taken place since 1977.
4. The upper reach of the Harbor, slip #3, is not affected by sediments originated from Lake Michigan.
5. The probable source of siltation of slip #3 (surface area 70,000 ft²) is the overland flow and storm sewers with outlets into slip #3.
6. Overland flows and storm sewers carry the dust and dirt accumulated in street curbs and parking areas. An estimate was made of the amount of solids that could reach slip #3. The estimate was based on published values^(a) for other cities in the U.S. for similar (industrial) land use, and for the City of Milwaukee, located in the same geographical area as Waukegan.
7. These estimates are:
 - o Based on the Milwaukee study: 560,000 lbs/year.
 - o Based on average values in U.S.: 290,000 lbs/year.

Considering a specific weight of 110 lbs/ft^3 these values would correspond to $5,100 \text{ ft}^3/\text{yr.}$ and $2,700 \text{ ft}^3/\text{yr}$ respectively. Moreover, if a uniform distribution of these sediments is assumed into slip #3 and with no movement of these sediments into other parts of the Harbor 0.5 to 0.9 inches of sediments might be expected to accumulate into slip #3.

Correspondingly, 13 to 24 years period would be required to accumulate one foot of sediments.

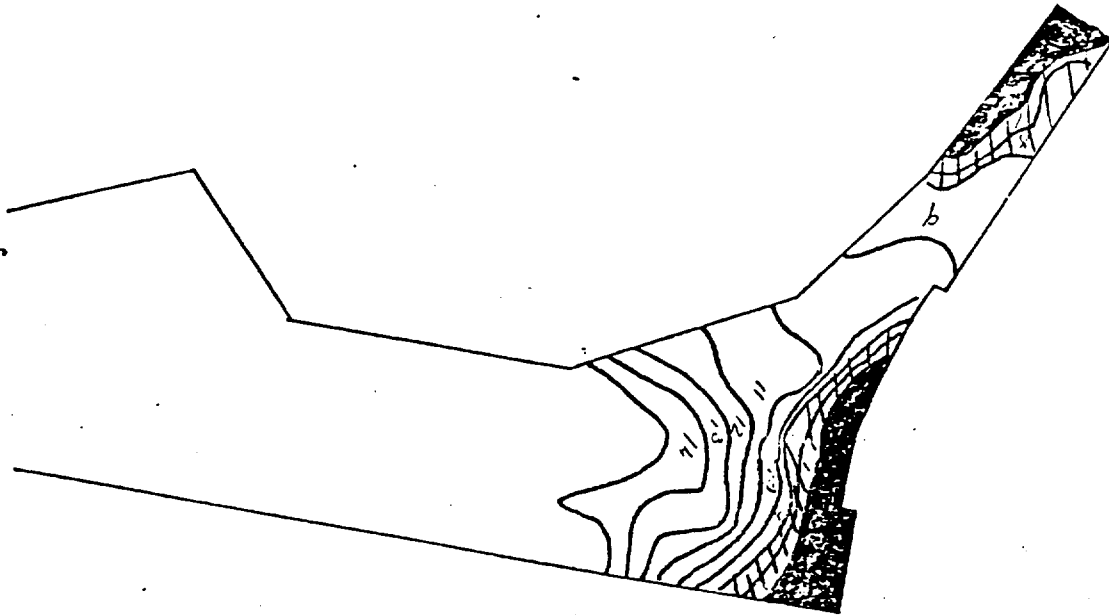
8. A similar analysis based on the Universal Soil Loss Equation^(a) results in similar values 0.05 to 0.1 ft/yr. Or 12 to 24 years to accumulate one foot of sediments.
9. A draft of 6 to 8 ft is required in slip #3 for the free movements of boats. Based on the bathometric contour map in Mason & Hanger report the attached figures were developed. Figure one identifies the areas in slip #3 with draft less than 6 to 8 ft. The draft is based on the low water datum of 576.8 ft.
10. The second figure projects those conditions into the future based on the values estimated above: 12 to 24 years to accumulate one foot of sediments.
11. Lake fluctuations - The hydrograph of monthly mean levels of Lake Michigan (1960-1980) are shown on Figure 3. The lake levels have a seasonal cyclicity. The annual low levels generally occur during the winter months (Jan. to March) and the high levels in summer (June to August). In addition to the seasonal variations, the annual mean levels appear to have a very low frequency cycle not unlike other hydrologic phenomena. Thus high water level years tend to follow each other and similarly for low water level years. However, it is difficult to predict when the next low water levels will begin.

An examination of the 1960-1980 hydrograph indicate that the levels were above the Low Water Datum (576.8 feet) since 1967. Record highs (from 1900 to 1980) were registered in 1973-74. However, during the 1963-64 years lake levels were close but generally below the Low Water Datum. The minimum of record was registered in March-April 1964.

12. Since the lake level fluctuates, the historical minimum lake level (575.4) is used in Figure 4 together with the present sediment conditions.
 13. The historical minimum lake level (575.4 ft) is used in Figure 5 together with projected sediment levels of 12-14/yr. Figure 3 shows that the totality of slip #3 will have a draft of less than 8 feet, with all of the mooring areas with drafts less than 6 feet.
- (a) Overton, D.E., M.E. Meadows, "Stormwater Modeling"
Academic Press, 1976

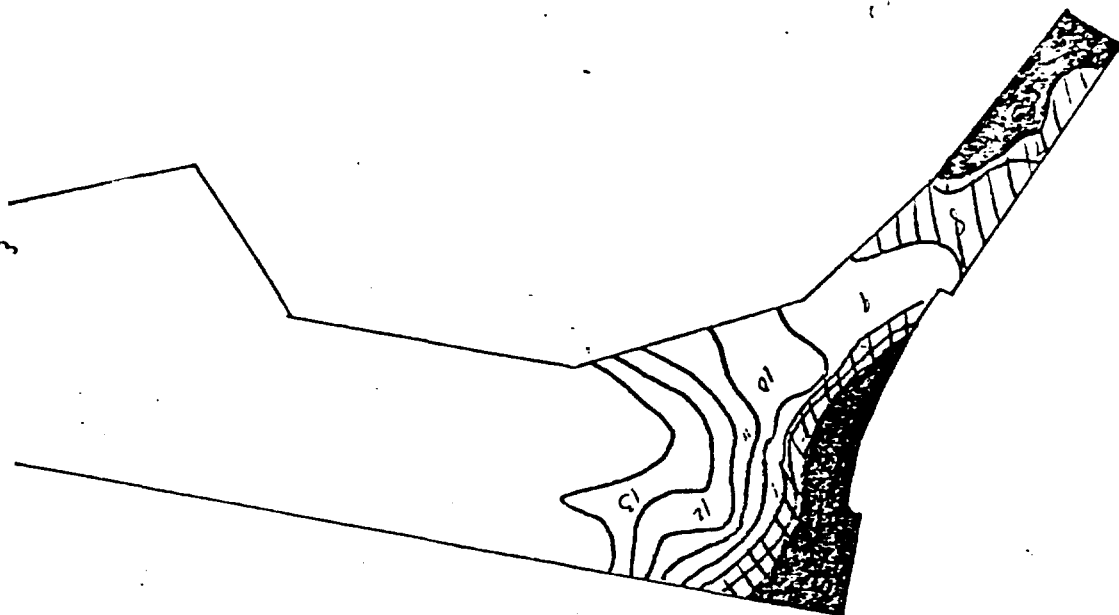
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cc: J. C. Henningson



Waukegan Harbor Slip # 3
 Depth of water above flood layer: Present conditions
 Water surface elevation @ low water datum: EL 576.8

Fig. 2

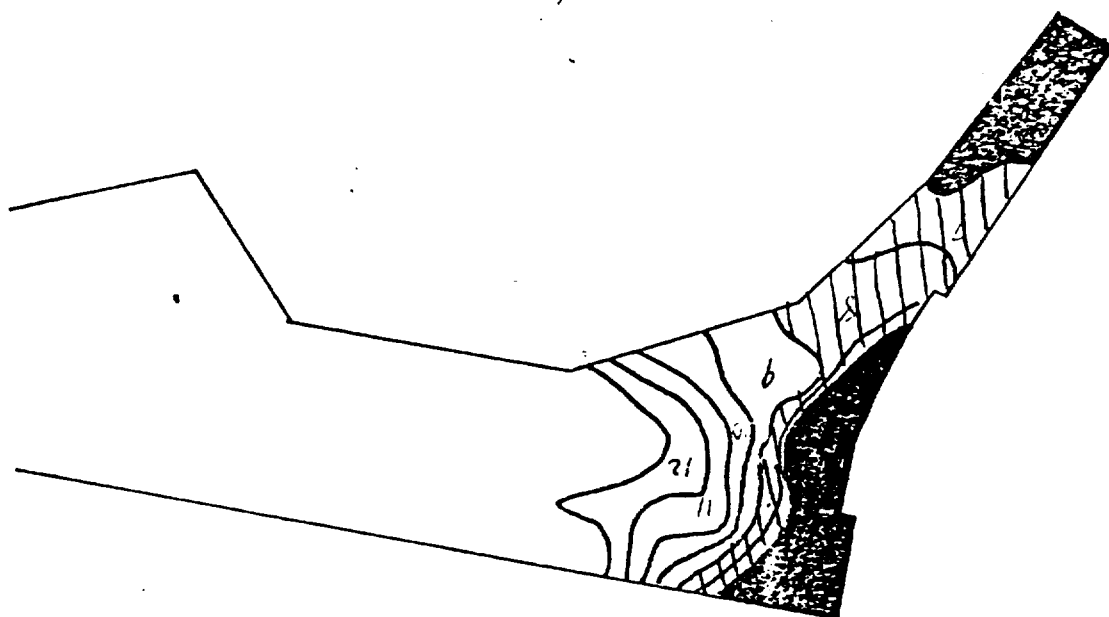


Waukegan Harbor Slip # 3

Future Condition
Depth of Water Above Duck Layer : 12-24 ft. Above

Water Surface Elevation @ Low Water Datum: El 576.8

WARRICK HARBOR SLIP # 3
 DEPTH OF WATER ABOVE ROCK LAYER : PRESENT CONDITIONS
 WATER SURFACE ELEVATION @ HISTORICAL MINIMUM LAKE
 LEVELS (575.35)



Waukegan Harbor Slip # 3

Depth of Water Above Duck Layer : Future Conditions

Water Surface Elevation @ Historical Minimum Lake
Level (575.35)

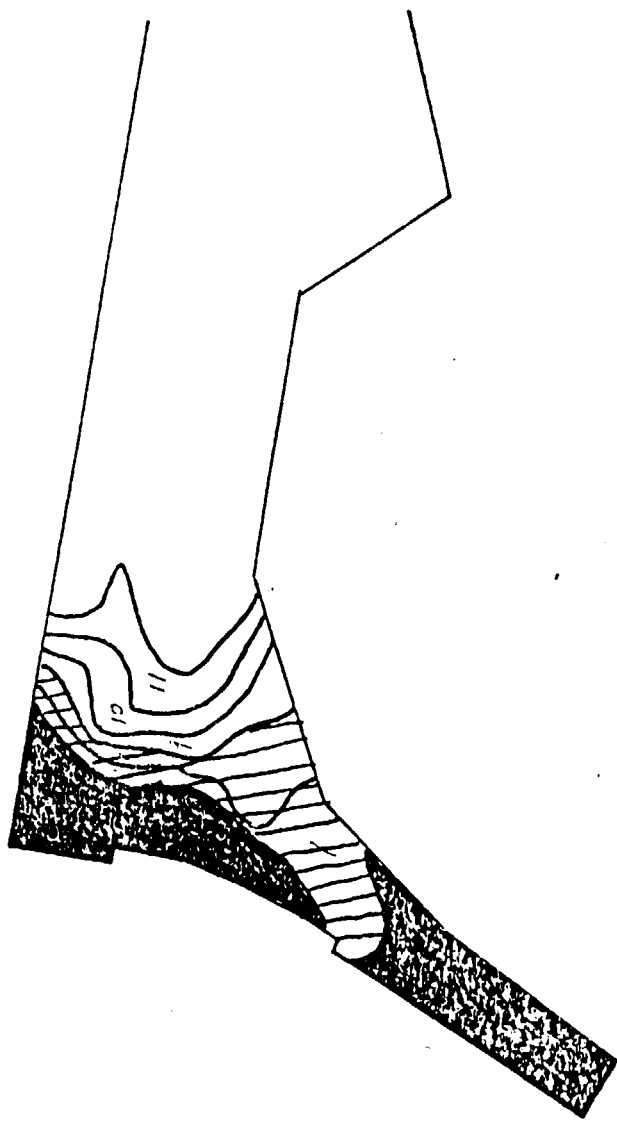


FIG 5



UNITED STATES - GREAT LAKES

HYDROGRAPH OF MONTHLY MEAN LEVELS OF THE GREAT LAKES

ELEVATIONS IN FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC, INTERNATIONAL GREAT LAKES DATUM (1965)

